arch extending from the E. to the S.W. by S. horizon, visible for ten minutes.

At 11h. 30m. only a few faint streamers, and at 12 o'clock the arch was again visible to the S.E., but aurora very faint.

During the progress of the display the peculiar undulatory phases noticed last year were particularly observed. The waves of light seemed to chase each other in rapid succession along the radiating streaks, coming into collision at the point of convergence. The semicircular masses surrounding this point appearing as if they occupied a *fixed* position in the sky, and becoming visible to the eye only as the intermittent waves reached them, somewhat analogous to the waves of the ocean dashing against a rock and breaking over it in a mass of white foam.

In conclusion may I venture to suggest the application of photography to auroral phenomena; and perhaps some of your readers might *practically* answer the query, "Can a photograph be taken of an auroral display?"

ROBERT MCCLURE

342, Argyle Street, Glasgow, Nov. 11

THERE was a brilliant display of Aurora Borealis here on the evenings of Thursday and Friday, November 9 and 10—especially the latter night. Towards 7 o'clock a hazy light began to spread itself over the northern sky, near the horizon, not unlike a brilliant twilight. At 8 P.M. two arches were quite distinct, the upper one being well defined, with its apex passing through the head of Ursa Major. Gradually streamers began to pass from this, and by 9h. 15m. the scene was simply gorgeous. I do not remember ever seeing the streamers so expanded—more like flames, nor possessing such intense whiteness, so much so, that the evening was almost as light as if the moon had been shining. After proceeding from the upper arch, their course was most rapid to the zenith—apparently passing at times behind clouds, then suddenly emerging—where a magnificent whirling motion was formed, which kept changing in true Protean fashion. A grand, though somewhat dingy, red haze next appeared in the west, which gradually ascended towards the zenith, when it disappeared. Meanwhile flashes of light, resembling summer lightning, darted upwards from about 45° from all directions, and not least from the south—the N.W. heavens assuming a muddy green colour. About a quarter-past ten P.M. the aurora gradually diminished, especially the upper arch, and streamers from it. Then the lower arch began to give off streamers, but these were short and of short duration, though of considerable brightness. The display of Friday, if it fell short of those of October 23 and 24, 1870, in point of brilliant colours, surpassed them in some respects—*e.g.* extent of streamers, and brilliancy of light. Barometer corrected and reduced 29·472: Temperature 32.°

THOMAS FAWCETT

Blencowe School, Cumberland

THERE was a very bright Aurora here last night: the streamers were white, with a red glow in some places. At about ten there was that beautiful and rare phenomenon—a "corona" of streamers converging at the zenith. The barometer was about 29·6. This morning is fine, with the barometer rising.

JOSEPH JOHN MURPHY

Old Forge, Dunmurry, Co. Antrim, Nov. 11

THERE have been two magnificent auroral displays on the nights of the 9th and 10th inst. That on the 9th commenced at 10 o'clock, and continued with little interruption until 12.45; and last night from 9.40 until 12 o'clock. Both displays were in the north and north-west, and at times the streamers reached the zenith, but I did not observe them to pass beyond that point. The colours were varied; at one time of a beautiful crimson, at another a greenish white. Last night's display was the most interesting, but not so brilliant as that of the previous night. The aurora made its first appearance by an undefined redness in the north; it then gradually developed into a crimson, and assumed the shape of a vertical pillar, the upper part tapering to a clearly defined point, within a few degrees of the zenith. It remained in this shape and position for two minutes, and then faded away. At 10.15 there appeared, at about 10 degrees above the horizon, a peculiar lightness, like the edge of a dark horizontal cloud illuminated by the hidden moon, but I could distinctly discern some stars below the illuminated *stratum*, which proves that the *cloud* was transparent; the stars could not, however, be seen through the lightness. At 10.40 there were three distinct streamers shooting up from this light, emanating from separate parts, but all in the north and north-west. They then assumed an easterly movement, the right hand streamer before disappearing being in the north-east. The centre one of these was of a very light colour, approaching a faint or whitish green; the others were crimson. At 11 o'clock I saw an exceedingly brilliant *patch* undefined in the north-east; by this time some clouds, stratified horizontally, rose from the northern horizon and passed into the light part of the heavens, which seemed to influence the display by intensifying the streamers, which were shooting up, at this time, to the zenith. At 11.30 I saw six beams start across east and west, of a whitish colour with dark spaces between, and the southern one in the zenith. The northern streamer now disappeared, but the *auroral twilight* was still visible, although gradually fading, and by 12 o'clock all was darkness. I did not continue my observation beyond this hour, the temperature not being conducive to personal comfort.

I may remark that with the exception of the few clouds which rose last night, both nights were perfectly cloudless, and the milky way shone with uncommon splendour. A portion of this band of stars at one time looked grand, as one mighty streamer ran along its course, some of the largest stars being visible through the intercepting redness.

I hope that some of your correspondents will give particulars of any magnetic disturbances which may have occurred on the nights of the above displays.

JOHN JEREMIAH

43, Red Lion Street, Nov. 11

P.S.—I have been informed that the white horizontal light mentioned in my communication of the 11th inst. was visible at 7.30 on the night of the 9th, but no streamers were seen until the time stated by me.

On Saturday night, at 7.45, I saw in the north-western sky a slight auroral redness, but it did not last more than two minutes.

Nov. 13 J. J.

NOV. 10th, 11 P.M.—I have just witnessed a most magnificent display of Aurora. I first saw it at 9.30. Here is an account of it. The bearings given are magnetic.

9.30 P.M.—On the W. was a deep crimson glow of the richest possible colour, about 50° broad and 60° high. From W.N.W. to N. the sky was filled by a mass of white light, pulsating in long horizontal masses moving upwards. At 9.36 they were moving, not very uniformly, at the rate of 33 waves per minute. From the N. to the E. extended a bright horizontal bend of steady white light, marked with vertical lines and having jagged edges. Suddenly from the centre of it shot up a vertical white streamer 3° or 4° wide; this remained stationary for a few minutes and then gradually faded away.

At 9.38 a fan-shaped mass of white light appeared at N.N.E. At 9.45 a band of white light extending from the horizon to a height of about 20°. From the centre of this streamed upwards a kind of waving flag of intense red light, about 20° broad and reaching to the zenith. At N.N.E. the fan was gone and a bright horizontal band of white light marked with vertical lines had taken its place. It was almost 40° long and 30° high. At 9.50 there appeared an arch of white light about 10° thick. The centre was about 60° high, white, the ends were on the horizon at E.N.E. and N.W. This vanished and was replaced by a horizontal white band, about 60° long and 10° high, the lower edge being about 20° above the horizon. Out of this presently rose four beautiful white streamers. At 9.52 an intensely bright red light was observed at W. At the N.E. were a few patches of white light. At the N.N.E. appeared about ten vertical white streaks for a minute or so. They were 15° high and filled a horizontal space of about 20°. At 9.53 a rather fine meteorite fell. At the N.W. was a red stream about 30° broad and 80° high, while at W.S.W. was a mass of red light. At 9.55 the mass of white light at E.N.E. threw out a number of jets of light in shape like the streams of water from the rose of a watering can. At 10 P.M. the arch which had vanished reappeared, reaching from W.N.W. to E.N.E. It glowed with a deep white light, which was motionless, except that at 10.2 I observed two downward waves. At 10.3 a long streamer grew out of it. At 10.5 the right-hand end was tossed up into the form of a haycock. At 10.8 a glow spread upwards from the centre of the arch, and filled the upper part of the sky. At the same time a slight patch of red light reappeared in the W. The sky to the S. was lighted up with the reflection of the white light in the N. The reflected light seemed to have a faint reddish tinge.

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By 10.10 nothing was left except the arch, and between 10.10 and 11 that also vanished.

The stars could be seen distinctly through the aurora. When the light was at the brightest I could see the figures and hands of a large watch, but could not distinguish the figures one from another. Thermometer 30·5 F. ; Barometer 29·69 inches.

Pixholme, Dorking, Surrey J. E. H. GORDON

Structure of Lepidodendron

PROFESSOR DYER has already discovered one of the many new facts with which he has yet to become familiar, and hastens, in a straightforward manner, to acknowledge the circumstance; but I must again remind him that this, along with many other facts, was described in No. 129 of the Proceedings of the Royal Society. Professor Dyer further says: "Suppose the transverse septa separating these cells absorbed, *as probably eventually they would have been*, and the rows of cells become scalariform vessels." But I can assure him, as a question of fact, that these cells do *not* become so changed; consequently his conclusion that the central cells and the investing vessels are but parts of "one central structure" becomes negatived. The separation of these two structures *increases* with age instead of *diminishing*.

W. C. WILLIAMSON

Encke's Comet

IT may interest those who possess small telescopes to know that this comet is now within the range of instruments of moderate apertures. On November 10 I had a very satisfactory view of it, with a 4″ equatorial by Cooke; no signs of a nucleus were observed, but there appeared to be a slight condensation of light on the *following* side of the comet. THOS. G. E. ELGER

Bedford, Nov. 11

The Science and Art Department

IN your last number there appears a letter signed "Henry Uhlgren," which, among other interesting statements, contains the following: Referring to Mr. Forster's statement in the House of Commons that there was no foundation for the report that "the Examiners after having made their reports had the papers returned to them, with an instruction to reduce the number of successful candidates, as an intimation had been given by a right hon. gentleman that the amount of the Grant due upon those papers must be reduced 20,000*l*.," Mr. Uhlgren states: "But previous to that a provincial local secretary, hearing the rumour, wrote to ask the Department if it were true, and received a reply saying it was true, and that instead of the amount being 20,000*l*. it was 40,000*l*. (the Department's letter can be produced.)" Premising that the amount of the whole vote for payments to teachers on results in science (which was to be reduced by 40,000*l*.) was 26,000*l*., may I ask for the production or publication of this extraordinary official letter? X

ECONOMICAL ALIMENTATION

IN glancing over the recent issues of the *Comptes Rendus*, one cannot but fail to be struck with the practical importance of many of the communications contained therein, a large proportion of which bear special reference to the Siege of Paris. In nearly every branch of science there is some endeavour made to supplement and improve our knowledge in matters such as were then of the greatest importance, and the members of the *Académie* have come forward eagerly to aid, by advice and precept, in overcoming the misery of a prolonged siege. Unfortunately, but little could be done, even by such men as Fremy, Dumas, Chevreul, and others, against the insuperable difficulties which presented themselves; but nevertheless Paris owes much to her men of science who contributed many services of value, at a time when these were most needed. The manufacture and employment of nitro-glycerine in mines and shells, were successfully accomplished at a crisis when the stock of gunpowder was running terribly short, and the supply of some other reliable explosive was rendered imperative. Hitherto nitro-glycerine had been regarded as a most dangerous combustible, liable to explode at the slightest concussion, and yet we hear of its employment in shells against the Prussians, thundered forth from guns of the heaviest calibre, without one single instance of its premature explosion being recorded. Again the question of ballooning, although not perhaps very far advanced by the deliberations of the *Académie*, has, at any rate, been more satisfactorily solved than at any previous period, and Paris has been certainly the first to employ these frail and romantic contrivances in a practical every-day manner, and thus to render the words, "*par ballon monté*" familiar to the ear as a household phrase. In matters of surgery, as in those of a sanitary nature, sound advice was not wanting, and even the abstract calling of the soldier, —the philosophy of his manner of fighting—formed the theme of much scientific discussion.

But the most interesting, perhaps, of all the subjects with which the *Académie des Sciences* busied itself, was that of seeking an economical means of alimeniation for the inhabitants of Paris during the siege. Given certain limited sources of supply, a fixed amount of suitable organic matter, and the problem was how to use the same to the fullest and most profitable degree. Of sheep and oxen there was but an exceedingly limited provision in proportion to the very populous state of the city, and although corn and wine were said to be in abundance, there is no doubt the authorities were from the first sorely troubled by the vague estimates that were published of these comestibles.

As a suitable manner of economising corn, M. Gauldrée called attention to the method in vogue among the Romans of parching and bruising the grains, which in this state may be made to yield an excellent and highly nutritious soup or porridge. The corn is carefully sifted by hand, browned without charring, until it breaks when taken between the teeth, and then ground in any available mill; it is mixed with cold water, boiled for thirty minutes, and seasoned as desired. So economical was this preparation, that at the public kitchens, established in certain quarters of Paris, it was possible to dispense one portion of *bouillie romaine* together with a small modicum of wine for the amount of five centimes.

A proposition to manufacture artificial milk, brought forward by M. Gaudin, seems worthy of some notice. That gentleman estimated that 500,000 litres per day of milk could be prepared in Paris at an exceedingly trifling cost, which should have all the nutritious qualities of good milk, and which should, besides, be neither unpleasant of taste or smell. An emulsion at a very high temperature is made of *bouillon de viande* prepared from bones, fat, and gelatine, and when cold, a product is obtained resembling in taste stale milk of a cheesy flavour; the components of ordinary milk are all present, the gelatine representing the casein; fat, the butter; and sugar, the sugar of milk. For admixture with coffee, chocolate, soup, &c., the milk is said to be by no means disagreeable.

Many propositions were brought forward to economise the blood from the abattoir, the plan suggested by M. Gaultier of mixing it with flour in the manufacture of bread being perhaps the best and simplest, as the fibrine and albumen, so rich in nitrogen—of which the alimentary properties are well known—are in this way utilised to the highest degree. Less inviting is the proposal of M. Fud to consume he carcases of animals that died of typhus, rhinderpest, and other diseases, the flesh in these instances being, so asserts M. Fud, capable of use as food, if only cooked in a suitable manner.

More important, however, than all, is M. Fremy's attempt to bring forward osseine as an article of food. Osseine is essentially different from gelatine, which has recently been asserted by chemists—erroneously, so M. Fremy thinks—to be not only unnutritious, but positively injurious to the human system. Leaving, however, the question of gelatine on one side, M. Fremy proceeds to advance the qualifications of osseine as an alimentary substance. Although gelatine and osseine are isomeric, in the same way as starch and dextrine are isomeric, they

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